# On the use of analyser-based phase-contrast imaging to reconstruct the complex amplitude reflection coefficient of a laterally homogeneous crystal

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The use of a near-perfect slab of analyser crystal, for phase-contrast X-ray imaging, is well known. In one common variant of the method, monochromatic plane X-ray waves may be caused to pass through a sample, with the resulting transmitted field being diffracted from the surface of the analyser crystal. This diffracted field is then registered using a position sensitive detector, to yield an analyser-based phase contrast image.

Rather than considering the crystal as an optical element which is used to probe the sample, the sample may be considered as an optical element which is used to probe the crystal. Indeed, one may ask the following question: if the complex X-ray transmission function of a suitably-structured weak sample is known, can one infer the complex amplitude reflection coefficient of an analyser crystal, given a single analyser-based phase contrast image of the thin sample which is obtained using this crystal? Here we answer this question in the affirmative, by developing an algorithm for measuring the crystal's complex amplitude reflection coefficient in this manner.

After outlining the theory behind the method, we will use computer simulations to demonstrate its application to both a thick perfect crystal, and a linearly strained thin crystalline film. For the latter model, and under conditions in which the kinematical approximation is valid, one may invert the retrieved complex amplitude reflection coefficient to recover the one-dimensional deformation profile of the structure.